

CLAIMS

1. A method for imaging one or more features of an object, the object comprising multiple attributes, the method comprising the steps of:
 - a. selecting a first attribute and a second attribute, the first attribute and the second attribute each having its own vertices;
 - b. creating a normal map using at least one of the first and second attributes, the normal map having its own vertices;
 - c. converting the normal map vertices and the vertices of the at least one of the first and second attributes used to create the normal map into a matrix representing a tangent space normal map;
 - d. calculating a diffuse lighting component from the tangent space normal map and the at least one of the first and second attributes used to create the normal map; and
 - e. combining an ambient lighting component with the diffuse lighting component and at least one of the first and second attributes to form an image representing a select feature of the object that is substantially indistinguishable in its natural environment.
2. The method of claim 1, wherein at least one of the first attribute and the second attribute comprise a combination of two or more attributes.

3. The method of claim 2, wherein the combination of two or more attributes form a hybrid attribute.
4. The method of claim 2, wherein the first attribute comprises any combination of two or more attributes comprising amplitude, frequency, phase, power, semblance, coherency, dip, azimuth, gradient, fluid factor, acoustic impedance, velocity, pressure, porosity, permeability, stratigraphy and lithology and the second attribute comprises at least one attribute from amplitude, frequency, phase, power, semblance, coherency, dip, azimuth, gradient, fluid factor, acoustic impedance, velocity, pressure, porosity, permeability, stratigraphy and lithology.
5. The method of claim 1, wherein the ambient lighting component and diffuse lighting component are combined with the first attribute and the second attribute is used to create the normal map.
6. The method of claim 1, wherein the ambient lighting component and the diffuse lighting component are combined with the first attribute and the first attribute is used to create the normal map.
7. The method of claim 1, further comprising the steps of:
 - a. selecting a third attribute, the third attribute having its own vertices;
 - b. creating another normal map using at least one of the first, second and third attributes, the another normal map having its own vertices;

- c. converting the another normal map vertices and the vertices of the at least one of the first, second and third attributes used to create the another normal map into another matrix representing another tangent space normal map;
 - d. calculating another diffuse lighting component from the another tangent space normal map and the at least one of the first, second and third attributes used to create the another normal map; and
 - e. combining the ambient lighting component with the another diffuse lighting component and at least one of the first, second and third attributes to form another image representing a select feature of the object.
8. The method of claim 7, wherein the third attribute comprises the combination of the ambient lighting component, the diffuse lighting component and the at least one of the first and second attributes.
9. The method of claim 8, wherein the another normal map is created using at least one of the first and second attributes and the third attribute is combined with the ambient lighting component and the another diffuse lighting component to form the another image.
10. The method of claim 8, wherein the another normal map is created using the third attribute and the third attribute is combined with the ambient lighting component and the another diffuse lighting component to form the another image.
11. The method of claim 1, further comprising the step of displaying at least a portion of the image to a user.

12. The method of claim 11, wherein the image displayed is displayed on at least a portion of one of a plurality of planar surfaces defining a probe.
13. The method of claim 11, wherein the image displayed is displayed at least partially within a plurality of planar surfaces defining a probe.
14. The method of claim 1, wherein the first attribute and the second attribute each comprise multiple data values and associated spatial coordinates, each data value having a spatial coordinate (x, y, z).
15. The method of claim 14, wherein the normal map comprises multiple perturbed normal vectors that are derived from the cross product of a vertical component and a horizontal component for each data value.
16. The method of claim 1, wherein a vertex program is used to convert the normal map vertices and the vertices of the at least one of the first and second attributes used to create the normal map into the matrix representing the tangent space normal map.
17. The method of claim 1, wherein the diffuse lighting component and the ambient lighting component are each calculated using a register combiner.
18. The method of claim 17, wherein the ambient lighting component, the diffuse lighting component and the at least one of the first and second attributes are combined using the register combiners to form the image.
19. The method of claim 1, wherein the first attribute and the second attribute comprise medical data.

20. The method of claim 1, wherein the first attribute and the second attribute comprise seismic data.
21. The method of claim 1, wherein the ambient lighting component is a predetermined constant.
22. The method of claim 1, further comprising the steps of:
 - a. calculating a specular lighting component from the tangent space normal map and the at least one of the first and second attributes used to create the normal map; and
 - b. combining the specular lighting component, the ambient lighting component, the diffuse lighting component and the at least one of the first and second attributes to form the image.
23. The method of claim 1, further comprising the steps of:
 - a. applying an imaginary light source to the image;
 - b. displaying a portion of the image to a user;
 - c. interactively repositioning at least one of the imaginary light source and the displayed image relative to a line of sight of the displayed image to the user; and
 - d. repeating steps c, d and e in claim 1.

24. A method for imaging one or more features of an object, the object comprising multiple attributes, the method comprising the steps of:

- a. selecting an attribute, the attribute having its own vertices;
- b. creating a normal map using the attribute, the normal map having its own vertices;
- c. converting the normal map vertices and the vertices of the attribute into a matrix representing a tangent space normal map;
- d. calculating a diffuse lighting component from the tangent space normal map and the attribute; and
- e. combining an ambient lighting component with the diffuse lighting component and the attribute to form an image representing a select feature of the object that is substantially indistinguishable in its natural environment.

25. A method for imaging one or more features of an object, the object comprising multiple attributes, the method comprising the steps of:

- a. selecting a first attribute and a second attribute, the first attribute and the second attribute each having its own vertices;
- b. creating a normal map using at least one of the first and second attributes, the normal map having its own vertices;

- c. converting the normal map vertices and the vertices of the at least one of the first and second attributes used to create the normal map into a matrix representing a tangent space normal map;
- d. calculating a diffuse lighting component from the tangent space normal map and the at least one of the first and second attributes used to create the normal map;
- e. combining an ambient lighting component with the diffuse lighting component and at least one of the first and second attributes to form an image representing a select feature of the object; and
- f. displaying at least a portion of the image to a user, the portion of the displayed image comprising at least part of the first attribute and part of the second attribute.

26. The method of Claim 25, wherein the select feature of the object is substantially indistinguishable in its natural environment.

27. A system comprising a program storage device readable by a machine, the storage device embodying a program of instructions executable by the machine for imaging one or more features of an object, the object comprising multiple attributes, the system comprising:

- a. a first attribute and a second attribute, the first attribute and the second attribute each having its own vertices;
- b. a normal map derived from at least one of the first and second attributes, the normal map having its own vertices;

- c. a means for converting the normal map vertices and the vertices of the at least one of the first and second attributes used to create the normal map into a matrix representing a tangent space normal map;
 - d. a means for calculating a diffuse lighting component from the tangent space normal map and the at least one of the first and second attributes used to create the normal map; and
 - e. a means for combining an ambient lighting component with the diffuse lighting component and at least one of the first and second attributes to form an image representing a select feature of the object that is substantially indistinguishable in its natural environment.
28. The system of claim 27, wherein at least one of the first attribute and the second attribute comprise a combination of two or more attributes.
29. The system of claim 28, wherein the combination of two or more attributes form a hybrid attribute.
30. The system of claim 28, wherein the first attribute comprises any combination of two or more attributes comprising amplitude, frequency, phase, power, semblance, coherency, dip, azimuth, gradient, fluid factor, acoustic impedance, velocity, pressure, porosity, permeability, stratigraphy and lithology and the second attribute comprises at least one attribute from amplitude, frequency, phase, power, semblance, coherency, dip, azimuth, gradient, fluid factor, acoustic impedance, velocity, pressure, porosity, permeability, stratigraphy and lithology.

31. The system of claim 27, wherein the ambient lighting component and the diffuse lighting component are combined with the first attribute and the second attribute is used to create the normal map.
32. The system of claim 27, wherein the ambient lighting component and the diffuse lighting component are combined with the first attribute and the first attribute is used to create the normal map.
33. The system of claim 27, further comprising:
- a. a third attribute, the third attribute having its own vertices;
 - b. another normal map derived from at least one of the first, second and third attributes, the another normal map having its own vertices;
 - c. a means for converting the another normal map vertices and the vertices of the at least one of the first, second and third attributes used to create the another normal map into another matrix representing another tangent space normal map;
 - d. a means for calculating a diffuse lighting component from the another tangent space normal map and the at least one of the first, second and third attributes used to create the another normal map; and
 - e. a means for combining the ambient lighting component with the another diffuse lighting component and at least one of the first, second and third attributes to form another image representing a select feature of the object.

34. The system of claim 33, wherein the third attribute comprises the combination of the ambient lighting component, the diffuse lighting component and the at least one of the first and second attributes.

35. The system of claim 34, wherein the another normal map is created using at least one of the first and second attributes and the third attribute is combined with the ambient lighting component and the another diffuse lighting component to form the another image.

36. The system of claim 34, wherein the another normal map is created using the third attribute and the third attribute is combined with the ambient lighting component and the another diffuse lighting component to form the another image.

37. The system of claim 27, further comprising a monitor, the monitor displaying at least a portion of the image to a user.

38. The system of claim 27, wherein the first attribute and the second attribute each comprise multiple data values and associated spatial coordinates, each data value having a spatial coordinate (x,y,z).

39. The system of claim 38, wherein the normal map comprises multiple perturbed normal vectors that are derived from the cross product of a vertical component and a horizontal component for each data value.

40. The system of claim 27, wherein the first attribute and the second attribute comprise medical data.

41. The system of claim 27, wherein the first attribute and the second attribute comprise seismic data.
42. The system of claim 27, wherein the ambient lighting component is a predetermined constant.
43. The system of claim 27, further comprising:
 - a. a means for calculating a specular lighting component from the tangent space normal map and the at least one of the first and second attributes used to create the normal map; and
 - b. a means for combining the specular lighting component, the ambient lighting component, the diffuse lighting component and the at least one of the first and second attributes to form the image.
44. The system of claim 27, further comprising:
 - a. an imaginary light source that is applied to the image;
 - b. a monitor for displaying a portion of the image to a user; and
 - c. a means for interactively repositioning at least one of the imaginary light source and the displayed image relative to a line of sight of the displayed image to the user.

45. A system comprising a program storage device readable by a machine, the storage device embodying a program of instructions executable by the machine for imaging one or more features of an object, the object comprising multiple attributes, the system comprising:

- a. an attribute, the attribute having its own vertices;
- b. a normal map derived from the attribute, the normal map having its own vertices;
- c. a means for converting the normal map vertices and the vertices of the attribute into a matrix representing a tangent space normal map;
- d. a means for calculating a diffuse lighting component from the tangent space normal map and the attribute; and
- e. a means for combining an ambient lighting component with the diffuse lighting component and the attribute to form an image representing a select feature of the object that is substantially indistinguishable in its natural environment.

46. A system comprising a program storage device readable by a machine, the storage device embodying a program of instructions executable by the machine for imaging one or more features of an object, the object comprising multiple attributes, the system comprising:

- a. a first attribute and a second attribute, the first attribute and the second attribute each having its own vertices;
- b. a normal map derived from at least one of the first and second attributes, the normal map having its own vertices;

- c. a means for converting the normal map vertices and the vertices of at least one of the first and second attributes used to create the normal map into a matrix representing a tangent space normal map;
- d. a means for calculating a diffuse lighting component from the tangent space normal map and the at least one of the first and second attributes used to create the normal map;
- e. a means for combining an ambient lighting component with the diffuse lighting component and at least one of the first and second attributes to form an image representing a select feature of the object; and
- f. a monitor for displaying at least a portion of the image to a user, the portion of the displayed image comprising at least part of the first attribute and part of the second attribute.

47. An image representing a select feature of an object, the object comprising multiple attributes, the image comprising a first attribute and a second attribute and at least a portion of the image being visible to a user, the portion of the visible image comprising at least part of the first attribute and part of the second attribute, the at least part of the first attribute and part of the second attribute also being simultaneously visible to the user.